NOVEMBER, 1926 BULLETIN 238

AGRICULTURAL EXPERIMENT STATION

KANSAS STATE AGRICULTURAL COLLEGE
MANHATTAN, KANSAS

CORN PRODUCTION IN KANSAS

PRINTED BY KANSAS STATE PRINTING PLANT
B. P. WALKER, STATE PRINTER
TOPEKA 1926
11-4690

SUMMARY

Kansas produces annually more corn than any other cereal, except wheat, the average production of the two crops for the past ten years being practically equal. The average annual yield for the 10-year period, 1915 to 1924 inclusive, was 18.4 bushels per acre. This low acre yield is due primarily to growing the crop under conditions to which it is not adapted.

Corn thrives best on deep, fertile, friable loam soils, where the climate is warm and humid, with frequent showers and plenty of sunshine. It is easily injured by drouth and hot winds.

Rotations including corn, small grains, and a legume are practical for most eastern Kansas farms.

Home-grown seed of an acclimated variety, suitable in size and maturity and of good quality, gives best results.

The popular opinion that it is necessary to change seed every few years is erroneous.

Two general methods of planting corn are practiced in Kansas; namely, surface planting and listing. The two methods are each adapted to certain conditions, and are superior one to the other only when the conditions to which they are respectively adapted exist.

The listing method of planting corn is adapted to regions having limited rainfall and light types of soil. Listed corn can be planted and cultivated more readily and cheaply than surface-planted corn, and is more drouth-resistant.

The surface-planting method is best for regions having abundant precipitation and heavy types of soil. Surface-planted corn is not as susceptible to damage from heavy rains as is listed corn, makes a quicker and more abundant growth, and under favorable conditions develops a larger capacity for production.

Early and thorough preparation of the seedbed for corn usually results in profitable increases in yield.

The best time to plant in northern Kansas is from May 1 to May 20; in southern Kansas from April 10 to May 1.

Much of the corn grown in Kansas is planted too thick, Under average conditions a stand that will average one stalk every 21 to 24 inches in eastern Kansas, and every 30 to 36 inches in western Kansas, is sufficient to produce maximum yields. Early-maturing, small-growing varieties should be planted thicker than large-growing, late-maturing varieties.

Experiments show that the most important purpose of cultivation is to kill weeds. The opportuneness of the cultivations is more important than the number.

Deep late cultivations that result in the destruction of many corn roots may do more harm than good.

Corn dry enough to crib when kept under the best of conditions, will shrink in weight from 5 to 10 per cent when stored for a period of six months or more. Shrinkage will be greater if the corn is not reasonably dry when put in the crib or if there is loss from mice, rats, or the weather.

The vitality, or germinating power, of the seed planted has much to do with the yield obtained. A high degree of vitality in seed corn is best indicated by firm ears and bright, glossy kernels.

Seed corn should be selected in the field after the corn is mature and before the first hard freeze occurs, and should be thoroughly dried before it is subjected to freezing temperature.

A germination test should always be made to determine the vitality of the seed to be planted.

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S. C. SALMON

INTRODUCTION

Kansas produces annually in round numbers about one hundred million bushels of corn, the average crop for the past ten years being practically equal to that of wheat. (Fig. 1.) Not only is the average yield very low—18.4 bushels for the ten-year period ending with 1924—but the yields fluctuate greatly from year to year as in 1913 when the crop was practically a failure and in 1915 when the average for the entire state was more than 31 bushels per acre. (Figs. 2, 3, and 4.)

The low average is due in the main to unfavorable climatic conditions in much of the territory in which corn is planted. It is also due to poor cultural methods, the ravages of insects, and the depletion of the soil because of continuous cropping.

There would seem to be two ways in which this situation may to some extent be remedied. One of them is to substitute sorghums for corn in certain parts of the state where the former are much better adapted, and the second is to give more attention to the rotation of crops and those methods of culture which may be expected to control insects and increase yields.

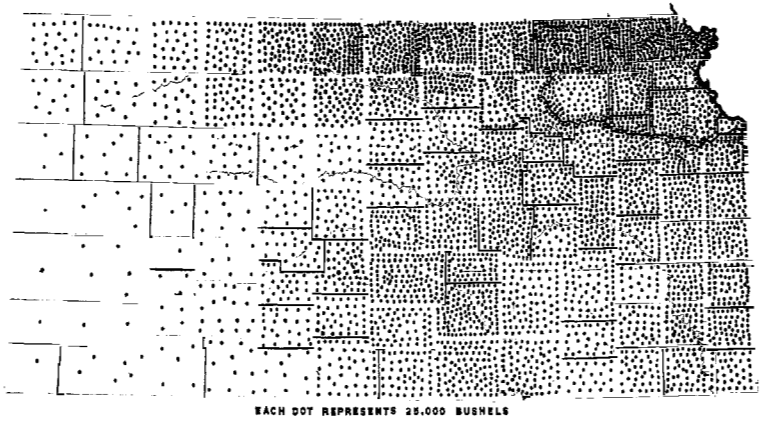

FIG. 1.—Map showing the average annual production of corn in Kansas, 1906 to 1915, inclusive.

Acknowledgment: The writer is deeply indebted to Mr. C. C. Cunningham, author of Bulletin 205 of the Agricultural Experiment Station, of which the present bulletin is largely a revision. He is also indebted to Dr. A. M. Brunson for experimental data supplied for the seasons of 1923 and 1924, to Prof. H. H. Laude for experimental data relating to varieties secured in coöperation with farmers throughout the state, and to Prof. J. W. McColloch, of the Department of Entomology, for the section relating to corn insects. Experiments relating to time, method, and rate of planting corn, and cultivation of corn reported herein were conducted in coöperation with the Office of Cereal Investigations, United States Department of Agriculture.

1. Contribution No. 164 from the Department of Agronomy.

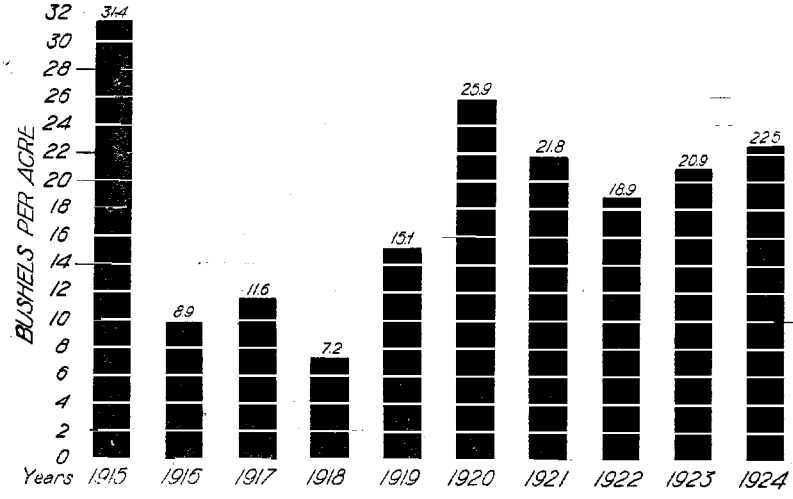

FIG. 2.—Average yield per acre of corn in Kansas: 1915 to 1924.

WHERE CORN SHOULD BE GROWN

Corn requires a better soil for its growth than do other cereal crops. It is also more likely to be injured by unfavorable climatic conditions. It grows best on deep, fertile soils in warm, moist climates, with frequent showers and plenty of sunshine. It is especially liable to injury by drouth and hot winds when it is silking and tasseling and when the ears are forming. It is usually an unprofitable crop on poor soils. In those sections of the state where mid-summer drouth, hot winds, and poor soils are found, other crops, such as the grain sorghums (kafir, milo, feterita, etc.), can frequently be substituted to advantage.

The Kansas Agricultural Experiment Station has made a study of the comparative value of corn and grain sorghums. Figure 5 is a map of the state divided into districts based upon the relative value of corn and kafir or other grain sorghums as shown by these investigations.

In the northeastern part of the state (district 1) corn is nearly every year a more profitable grain crop than kafir or other sorghums. The soils of this area are well adapted to corn and the rainfall is sufficient to mature large crops.

In district 2, corn is likely to be more profitable on rich bottom land and on the deeper upland soils, but on poor and shallow upland, kafir gives materially better yields.

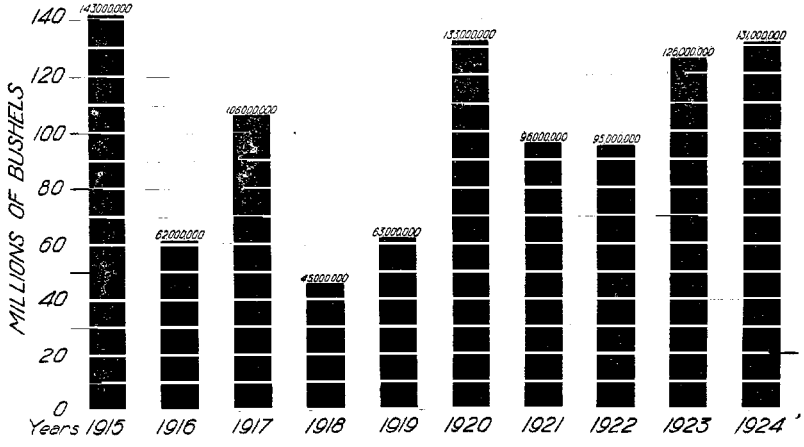

FIG. 3.—Annual production of corn in Kansas: 1915 to 1924.

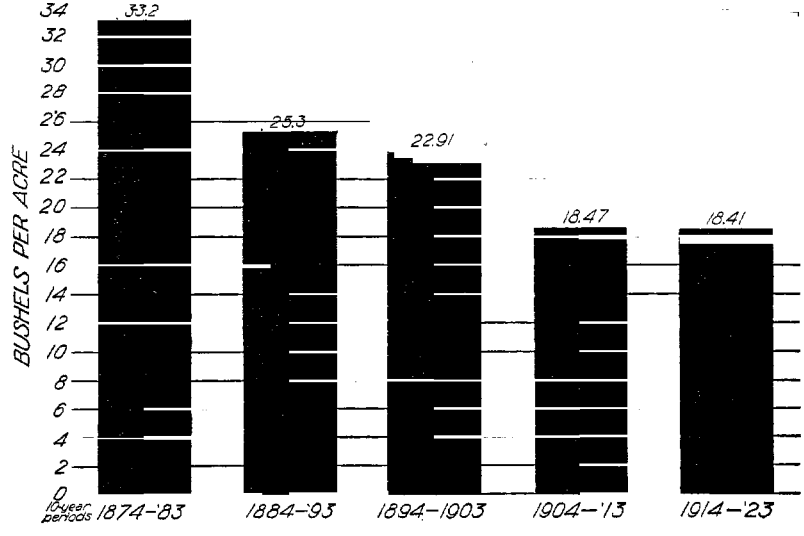

FIG. 4.—Average annual yield per acre of corn in Kansas by ten-year periods: 1874 to 1923.

In district 3, kafir almost always outyields corn on the medium to poor soils, while on the best land the relative yields of kafir and corn depend on the season. As a combined grain and forage crop, kafir will produce larger yields than corn on all soils in this section.

In extreme northwestern Kansas (district 4) early-maturing grain sorghums, such as Freed sorgo, milo, and feterita, may give better yields than corn in hot, dry seasons, but in wet seasons they yield less. The average yield of grain sorghums is usually less than that of corn. The elevation is high and the growing season is short. Corn can be planted earlier than the sorghums, and will thrive with cooler

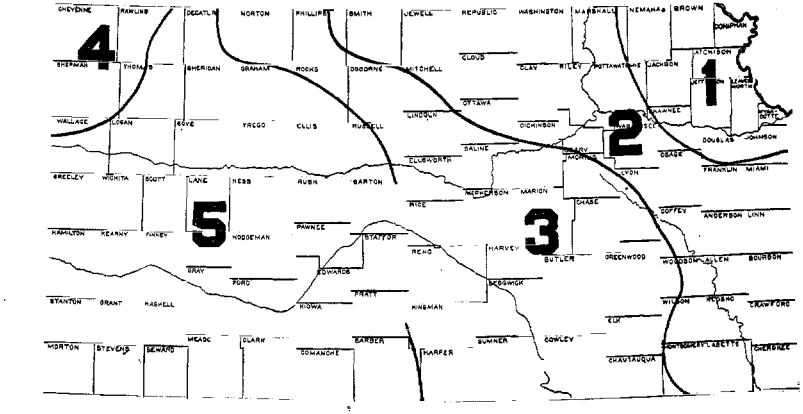

FIG. 5.—Map of Kansas showing areas best adapted to growing corn and the sorghums.

weather. For these reasons it has a longer growing season and considering average production, it is a more dependable crop.

In district 5 it is very seldom that corn will produce so large yields as the grain' sorghums, and it is almost always a less profitable crop, even when the greater cost of harvesting the grain sorghums is considered. Corn, however, is quite extensively grown on sandy creek and river bottoms.

ROTATIONS FOR CORN

A rotation of crops is good farm practice. By growing different crops the farmer is able to distribute his labor over a greater part of the year, and thus handle more ground with the same equipment. There is less risk of a total failure, since if drouth or hail injures or destroys one crop the others may escape injury.

A good rotation is especially important in growing corn since the

yields tend to decrease rapidly when corn alone is grown. (Fig. 6.) Yields are higher, weeds and insects are easier controlled, the soil is kept in better condition, and the corn is produced at less expense, if a good rotation is practiced. A rotation for corn should contain a legume and a small grain crop for the best results. It is especially important that a legume be included because of its effect on the fertility of the soil.

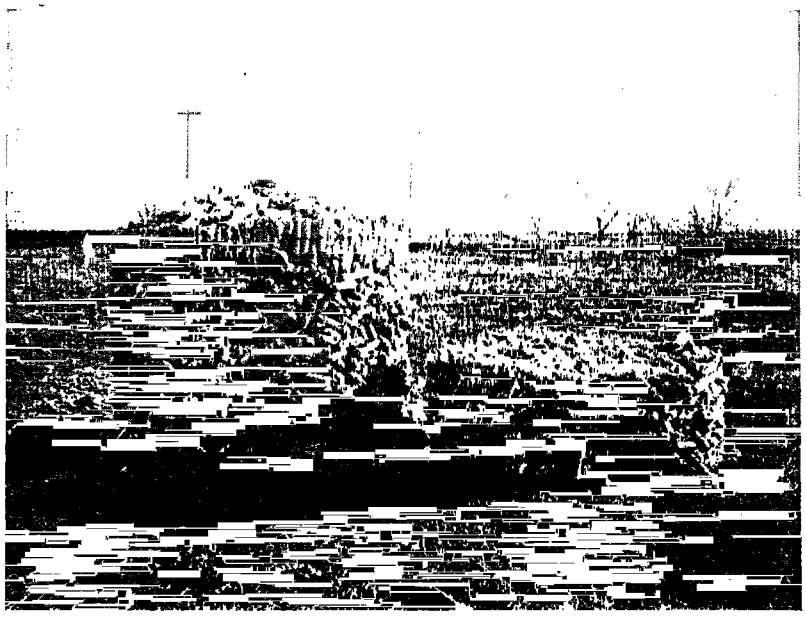

FIG. 6.—Effect of rotation on the yield of corn on the Agronomy Farm of the Agricultural Experiment Station, Manhattan, Kan. The pile on the left represents the yield (42 bushels per acre) when grown in rotation with other crops; that on the right the yield (23 bushels per acre) when grown continually on the same land.

Sweet Clover in Rotation with Corn.—There is probably no crop that will be more valuable in a rotation than sweet clover. Under favorable conditions it may be sown in the spring with a light seeding of oats and make a satisfactory growth after harvest which may be pastured, cut for hay, or plowed under in the fall or the following spring. (Fig. 7.) On dry uplands the chances of securing a stand are better if sown alone than with a nurse crop. Sweet clover can be grown on any well-drained soil in eastern or central Kansas that is not acid, and it should be used to rotate with corn much more extensively than is now done.

Red Clover.—Where red clover can be grown successfully it is an excellent crop to use in a rotation with corn. It is limited, however, to the northeastern part of the state since it will not survive the heat and drouth of other sections.

A rotation containing corn, wheat or oats, or both, and clover is perhaps the most practical one for the average farm in this area. The rotation can be varied to meet the needs of any particular farm. Corn may be grown one or two, or perhaps in a few cases, three

FIG. 7.—Sweet clover makes a rapid luxuriant growth which may be pastured or plowed under for green manure as seems to be most desirable.

years. It may then be followed by oats or wheat, and clover may be seeded in the small grain in the spring. Under normal conditions a good stand of clover will usually be obtained. The first crop of clover is usually cut for hay and the second for hay or seed, or plowed under for green manure. The best results in maintaining soil fertility are obtained when the second crop is used for green manure.

Alfalfa.—Alfalfa is an excellent crop to grow in rotation with corn from the standpoint of furnishing nitrogen and keeping the soil in physical condition. In the eastern half of the state there is perhaps no crop which can be grown in rotation with corn so successfully and at the same time is itself so profitable. Unfortunately there is frequently some difficulty in central Kansas, and in dry seasons in eastern Kansas, in growing corn on alfalfa sod. The alfalfa

leaves the ground rich in nitrogen which causes the corn to make a heavy growth, especially in the early part of the season. If hot winds and drouth occur later in the season, corn on alfalfa sod is the first to be injured. This fact may make alfalfa sod undesirable for corn in the less humid portions of the state. In such cases, kafir, sweet sorghum, or similar drouth-resisting crops are the more profitable ones to grow the first year or two. Corn can then follow these crops.

Soybeans. — In eastern Kansas, especially the three eastern tiers of counties, soybeans may be used to good advantage in a rotation with corn. They grow more successfully in soils somewhat more acid than will most other legumes and hence may often be used to advantage in such cases. They have not proved successful in central and western Kansas. Some good practical rotations are corn, wheat, and soybeans or corn, oats, wheat, and soybeans, each one year.

Soybeans are also grown with corn, the soybeans and the corn being planted at the same time. This practice is often desirable from the standpoint of supplying better feed, but it is doubtful if it can be recommended as a substitute for a good rotation.

VARIETIES OF CORN

Because of the great variation in soil, rainfall, and climate no one variety of corn is well adapted to growing in all part's of Kansas.

This fact is illustrated in Tables I and II, in which the yield of early-, medium-, and late-maturing varieties in different parts of the state and for different soils are compared.

TABLE I.—Effect of annual precipitation on the yields of large, medium, and small varieties of corn.

VARIETY.	Number of days to mature.	Average yield in bushels per acre.		
		Eastern Kansas.	Central Kansas.	Western Kansas.
Kansas Sunflower	125	44.3	20.1	10.1
Pride of Saline	115	42.1	21.8	13.3
Freed White Dent	105	38.8	27.2	18.5

Table I shows the relative yields of Kansas Sunflower, Pride of Saline and Freed White Dent in eastern, central, and western Kansas. Kansas Sunflower is a fairly late-maturing variety, Freed

White Dent is very early, while Pride of Saline is medium in this respect. It will be seen that with the favorable conditions of eastern Kansas the later-maturing varieties produce the highest and the early-maturing varieties the lowest yields. With the less favorable conditions of western and central Kansas the early-maturing varieties were the most productive.

TABLE II.—Relation of productiveness of the soil to yield of late, medium, and early varieties of corn.

VARIETY.	Number of days to mature.	Normal height of stalks in feet.	Yield—bushels per acre.	
			Poor soil.	Good soil.
Commercial White	125	8 to 10	25.8	50.4
Pride of Saline	115	7 to 9	28.9	48.1
Freed White Dent	105	6 to 8	31.9	43.5

As shown in Table II the same relation holds as to soil, *i.e.,* the late varieties tend to produce the highest yields on good soils and the early varieties on the poor soils. It naturally follows that where both soil and climate are very favorable very late-maturing varieties may be grown, whereas if both are unfavorable very early varieties should be grown. These facts should be of assistance to every farmer in helping him decide which is the best variety for his conditions.

ACCLIMATED VARIETIES BEST

Experiments conducted at the Agricultural Experiment Station and in cooperative tests conducted with farmers in various parts of the state show that home-grown seed of an acclimated variety will outyield seed introduced from other localities. (Figs. 8 and 9.) This is especially evident when corn is moved to a less congenial environment; that is, from a favorable to an unfavorable corn-growing locality. Results obtained in many experiments show that where a variety of corn has been grown in a given locality for many years, and the seed properly selected each season, that variety is, as a rule, a superior one for growing in that area.

This goes to prove that the general opinion that it is advisable to obtain new seed every few years is an erroneous one. The only time it is desirable to change seed is when a better variety can be secured or when for any reason no good home-grown seed is available.

FIG. 8.—An adapted variety of corn grown in the same field and under the same conditions as the corn in figure 9. Note the more vigorous growth of the stalks and the larger size of the ears as compared with the non-adapted corn.

FIG. 9.—A nonadapted variety of corn grown in the same field and under the same conditions as the corn in figure 8. Note the absence of well-developed ears and the difference in the condition of the stalks as compared with the adapted corn.

CHINCH BUG RESISTANT VARIETIES

In recent years several varieties grown in eastern states have been advertised as highly resistant to chinch bugs. These have been included in a number of experimental tests by the Agricultural Experiment Station. In general they were injured somewhat less by chinch bugs than some varieties but they did not appear to be decidedly more resistant than certain other varieties such as Pride of Saline and Commercial White, the adaptation and relative performance of which under different conditions is known. It seems unlikely that any material gain will be secured by growing these varieties, at least until more information concerning them is secured.

WHITE VERSUS YELLOW VARIETIES

Extensive feeding experiments have shown rather conclusively that when animals are fed in dry lots, yellow corn is likely to produce better gains than white corn. Where animals have access to pasture or green feed there appears to be no material difference.

It will be noted that most of the varieties listed in Table III have white grain and also that no yellow variety has equaled the better white ones in yield. This agrees with the experience of most Kansas farmers especially when conditions are somewhat unfavorable. There is no reason to believe that yellow varieties equally as productive as the white cannot be secured or produced, but so far none are known in spite of the fact that an extensive search has been made and numerous yellow varieties have been included in experimental trials. Pride of Saline has been crossed with certain yellow varieties and it is hoped that eventually by this or other means a productive yellow variety will be produced.

SOME GOOD VARIETIES TO GROW

A great many varieties and strains of corn are grown in the state. Some of these have been introduced from Iowa, Illinois, and elsewhere and have gradually become adapted to Kansas conditions by survival of the fittest. Others have been produced by selection. Many unnamed strains of local importance are being grown in various localities. No attempt is made here to mention all varieties. It is proposed to discuss only those that are most extensively grown or are especially adapted to certain conditions or sections.

Reid Yellow Dent.—Reid Yellow Dent is the most popular variety of the corn belt of the United States including Northeastern Kansas. It has never proved equal in yield to other varieties in

other parts of the state. It is adapted to favorable conditions but appears to be deficient in hardiness and lacks the ability to yield well on poor soil or in very dry localities. It is one of the best "show" varieties and on good soils in northeastern Kansas is as productive as any other yellow corn but does not give as high yields as the best white varieties.

Boone County White.—Boone County White has been grown extensively in Kansas for over 20 years. It is a medium-large variety maturing in from 120 to 125 days in average seasons. Like Reid Yellow Dent it is adapted especially to fertile land in eastern Kansas and is not well suited for other parts of the state.

Pride of Saline.—Pride of Saline has the widest range of adaptation of any variety grown extensively in Kansas. It has been included in numerous coöperative experiments in various parts of the state and has seldom failed to give a good account of itself as shown in Table III.

TABLE III.—Relative yields of Pride of Saline and other varieties in 524 coöperative tests with farmers in various parts of Kansas.

VARIETY.	Color of grain.	Average yield—bushels per acre.				
		North-eastern.	South-eastern.	North central.	South central.	Western.
Pride of Saline	white	43.5	31.8	37.2	27.2	22.3
Boone County White	white	37.2	28.0	33.7	24.8	20.0
Commercial White	white	42.1	31.4	35.6	25.6	19.7
Freed White Dent	white	32.0	29.1	35.5	24.6	25.2
Iowa Silvermine	white	39.5	28.5	33.4	23.7	21.9
Kansas Sunflower	yellow	39.1	29.1	36.1	24.8	19.1
Midland Yellow Dent	yellow	.....	30.1	33.3	25.3	.....
Reid Yellow Dent	yellow	39.7	26.4	33.7	24.0	16.7

Pride of Saline is a white variety maturing in 115 to 120 days or in about the same time as Reid Yellow Dent. The grain is rather smooth and not too deep nor starchy. It may be grown successfully in all except the extreme western and northwestern parts of the state where earlier-maturing varieties. are more dependable. It is not a show corn and hence is not a popular variety for this purpose.

Kansas Sunflower.—This variety is perhaps the best general purpose yellow corn available for growing in the state. It is adapted

especially to central and eastern Kansas except that in the northern part of this area it may not always thoroughly mature before frost. Generally speaking Kansas Sunflower has not proved to be a popular variety probably because it matures too late for average conditions. This objection should not be difficult to correct. Selection for an earlier type would undoubtedly increase its productiveness for many conditions and make it a more desirable variety.

Kansas Sunflower originated from a yellow variety introduced from Iowa into Douglas county in 1887. It was grown by Mr. John Moody, of Eudora, Kan., for a number of years. He sold the crop to the Barteldes Seed Company of Lawrence, Kan., who distributed it as Kansas Sunflower.

Commercial White.—Commercial White was originated by Mr. P. E. Crabtree in southwestern Missouri through selection of white-cobbed ears from St. Charles White, a variety that typically has red cobs. The plants are large and the ears are long but medium in circumference. The type of kernel is medium smooth. It matures in 125 to 130 days and therefore is too late for best results north of the Kansas river but is well adapted south of the river as far west as Reno county. It is especially well suited to the fertile soils of south central and southeastern Kansas.

Midland Yellow.—Midland Yellow was developed by Mr. O. A. Rhoads, of Columbus, Cherokee county, Kansas. It has been grown 40 years on the same farm and has been carefully selected. It is a medium-sized variety requiring 120 to 125 days to ripen. The kernels are a rich golden color and are slightly indented. Midland Yellow is particularly well adapted to southeastern Kansas where it has given better yields than any other yellow variety. In this region it is about equal to the two leading white varieties, Commercial White and Pride of Saline.

Freed White.—Freed White or Freed White Dent is an early, very hardy variety especially adapted to central Kansas and to the lighter soils and uplands of eastern Kansas. It matures in 100 to 110 days or from a week to 10 days earlier than Pride of Saline. Wherever the yields of corn are 30 bushels per acre or less Freed White Dent will ordinarily produce as large or larger yields than any other variety that may be grown.

It is a good variety to grow for early feed on the best corn lands and has been used with satisfactory results for planting with soybeans in eastern Kansas where the combined crop is to be hogged off,

Colby.—Colby or Colby Bloody Butcher has been grown for

many years in Thomas county, Kansas, and has been tested at the Colby Branch Experiment Station since 1914. It is a very hardy, early-maturing variety requiring about 100 days to mature. The kernels are red with either white or yellow caps. It probably originated from Northwestern Dent or from crosses between this variety and yellow or white varieties. It is well adapted to northwestern and western Kansas and farther east it is a good variety for early feed.

Some of the better varieties of corn and the area to which they are adapted are indicated in figure 10.

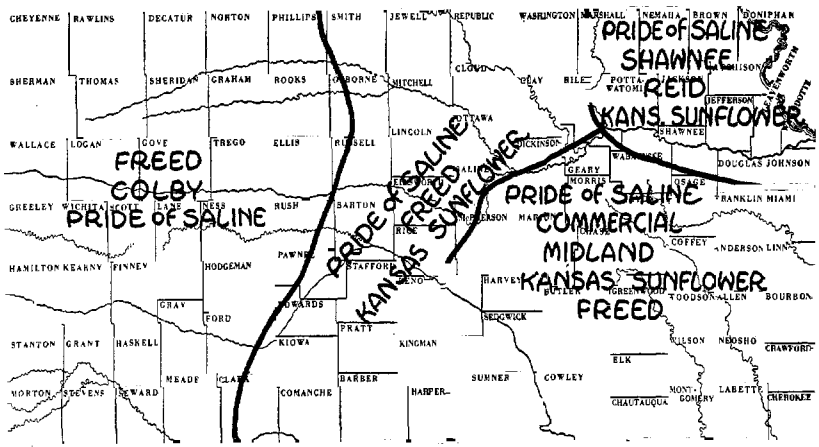

FIG. 10.—Standard varieties of corn for Kansas and areas to which they are adapted.

PLANTING CORN

Two general methods of planting corn are employed in Kansas; namely, surface planting and listing.

LISTING

Listing is adapted to regions having a limited rainfall and a comparatively light soil. It is used most extensively in central and western Kansas. (Fig 11.) For this area it has many advantages over surface planting, the principal ones being the ease and low cost with which the ground may be prepared and the corn planted and cultivated.

Listed corn stands dry weather better than surface-planted, and hence is especially adapted to areas where moisture is the limiting factor in growth. There are probably two reasons for the greater resistance to drouth of listed corn. The first is that the roots begin

their development deeper in the soil and are therefore less subject to drouth. The other, and perhaps more important reason, is that because of the less favorable growing conditions for the listed corn in the spring, it does not produce so much or so tender and succulent foliage as that which is surface-planted, and hence is less severely injured by dry hot weather.

Another advantage of listing not generally appreciated is the protection afforded the young corn plants in the spring against late

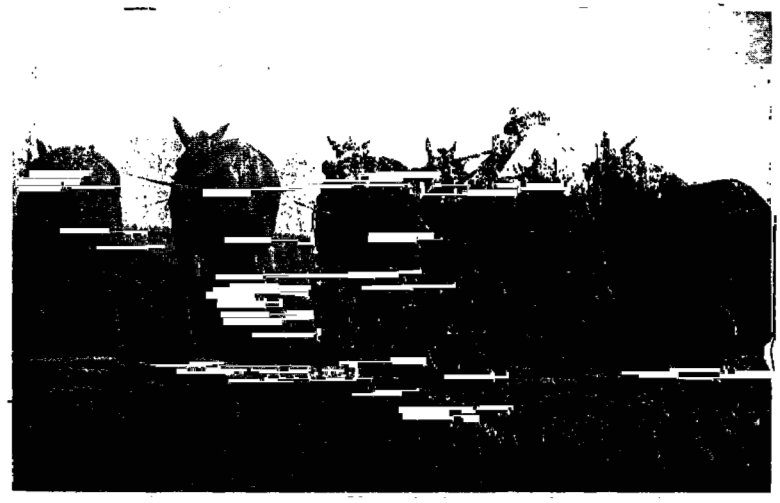

FIG. 11.—Listing for corn with a two-row lister; a rapid, inexpensive method of planting.

frosts. This is shown clearly in experiments at the Kansas Agricultural Experiment Station, Manhattan, Kan., in 1923 and 1924, in which the two methods of planting were compared. The per cent of plants killed by frost when planted by each of three methods, including listing is shown in Table IV.

TABLE IV.—Relation of methods of planting to injury by late frost.

YEAR.	Per cent of plants killed.		
	Listed.	Surface planted.	Planted in open furrows.
1923	10	89	85
1924	8	37	19
Average	9	63	52

It will be noted that as an average for the two seasons only 9 per cent of the listed corn was injured by frost whereas 63 per cent of the surface planted and 52 per cent of that planted in open furrows was killed.

The advantages, however, are not all in favor of listing. Corn planted by this method does not germinate as well and there is more danger that it will be covered by heavy dashing rains or washed out by water running down the furrows. Erosion in sloping fields is also an important factor unless the furrows are made to follow the contours of the field which is often difficult to do.

In experiments at Manhattan, conducted for many years, there has been no material difference in yield between listed and surface-planted corn. (Table V.) This means that in this territory and farther east the principal advantage of listing is the better control of weeds and low cost of production, and where this is sufficient to more than balance the objections mentioned above, listing is likely to be the favorite method of planting. In central and western Kansas, listing is not only a cheaper method of growing corn but it also produces larger yields because of the greater resistance to drouth as mentioned above.

SURFACE PLANTING

Surface planting is adapted to heavy, wet soils and to localities in the state where the rainfall is excessive in the spring. Where the annual precipitation is more than 35 inches, nearly all the corn should be surface planted. Corn planted in this way germinates better and makes a more rapid, vigorous growth during the early part of the season, largely because the growing conditions are more favorable near the surface than in the bottoms of the lister furrows. Because of the greater growth of foliage, surface-planted corn develops a larger, more vigorous stalk, and with a favorable season produces a larger yield. Ground that is in condition for surface planting does not wash so badly as that which is listed, and there is comparatively little danger of the young plants being destroyed by heavy dashing rains. The plowing of the ground, which is necessary where corn is surface planted, puts it into much better physical condition than is usually obtained by listing.

SHALLOW FURROW PLANTING

The shallow furrow method of planting corn is a modification of surface planting and has several advantages over the latter method. Furrow openers, consisting of a set of disks that are attached to the shoe of the planter open up a shallow furrow in which the corn is

planted. (Fig. 12.) A number of tests have been conducted by the Department of Agronomy of the Agricultural Experiment Station in which the shallow furrow method of planting has been compared with ordinary surface planting. The use of the furrow opener increased the average yield 1.5 bushels an acre in tests covering eight years. Corn planted in this way may be cultivated easier than that which is surface-planted. The spike-tooth harrow may be used with less injury, and the weeds in the row can be covered more readily

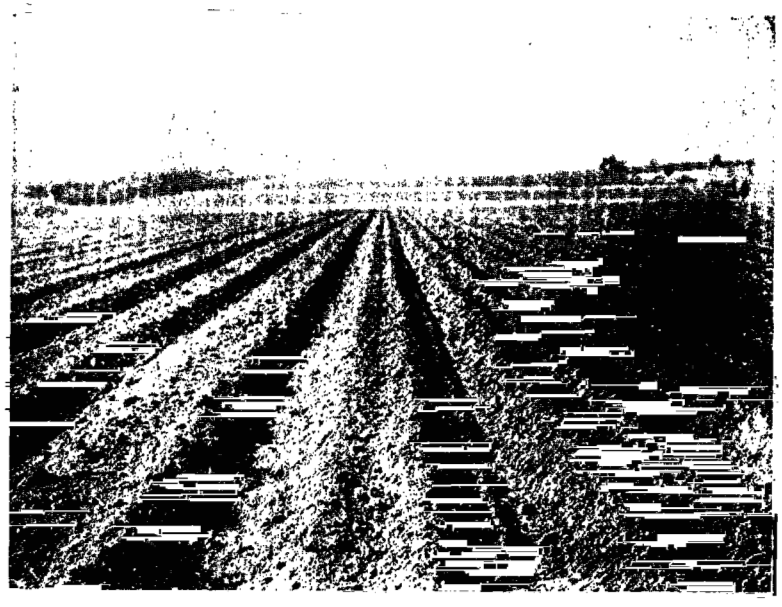

FIG. 12.—Field planted with disk furrow openers.

by early cultivation. In fact, many of the advantages of listed corn are obtained by the use of the furrow openers.

In western Kansas, where it is necessary to cover corn deeply to prevent the drying out of the loose soil over and around the kernels, the shallow furrow method of planting is not always practicable.

DOUBLE-SPACED PLANTING

There has been developed recently for western Kansas a method of growing corn in rows twice the usual distance apart. Two advantages are claimed for this method. The corn is said to survive the drouth better because the roots do not reach the centers between the rows until about the time the plant is in ear and most in need

of water. The moisture in the center therefore serves as a reserve available for the plants when they most need it instead of being used to produce an excessive vegetative growth which later proves detrimental. Also the seven-foot space is just sufficient for planting wheat with a drill between the rows of corn. The stalks of the latter are left to protect the wheat during the winter.

Certain experiments at the Fort Hays Branch Experiment Station and elsewhere have shown material gains both in yield of corn and of the following wheat crop by this method, but in other cases the results have not been so good. It appears quite certain that in favorable years the yields of corn will be less by this method than when planted in the usual way. It is therefore likely that it will prove desirable only in the drier portions of the state, and more information is necessary before it can be definitely recommended for any given territory.

CHECKING OR PLANTING IN DRILL ROWS

Results of experiments show that there is very little difference in yield from planting in hills or in drill rows where equivalent stands are obtained. The check-row method permits easier and more complete control of weeds, since the corn may be cultivated both ways. This is often very important, as continued wet periods frequently make it difficult to kill weeds in drilled corn. The general practice where corn is surface-planted is to check-row rather than to plant in drill rows. Drilling is the more practical method where the corn is listed.

THE TIME TO PLANT

The time to plant corn varies with the season and the locality. In the western part of the state the altitude must be considered, since the seasons become shorter with increasing elevation. Under average conditions there is a period of about three weeks during which corn may be planted with equal chances of success, although sometimes, because of peculiar climatic conditions, very early or very late plantings are best.

At Manhattan, corn has been planted at 10-day intervals from April 10 to June 1 with the results shown in Table V. In these experiments, which have been conducted for 11 years, there has been practically no difference in yield for any dates of planting between April 10 and May 10 except when the early planted corn has been injured by frost. This has occurred twice in the 11 years. (Table IV.)

There has usually been a marked reduction in yield from planting later than May 10, although in some seasons the best yields have been secured from planting as late as June 1.

TABLE V.—Relation of time and method of plainting to yield of corn.
(Manhattan, Kan., 1914 to 1924.)

METHOD OF PLANTING.	Date of planting and yield in bushels per acre.						
	April 10.	April 20.	May 1.	May 10.	May 20.	June 1.	Av.
Listed	49.1	49.6	50.8	48.9	42.7	41.5	47.1
Surface-planted	(a) 46.5	51.1	51.2	49.3	41.0	41.9	46.8
Planted in open furrows	(a) 49.6	49.0	50.7	53.1	43.7	43.0	48.2
Average	48.4	49.9	50.9	50.4	42.5	42.1	.....

(a) Injured by late spring frost in 1923 and 1924. Yields are from plots planted thick and thinned to a uniform stand after the frost.

In the vicinity of Manhattan it is usually desirable to have planting complete by May 10 and in favorable seasons it may begin as early as April 20 without material danger from late spring frosts. The most favorable dates should be earlier in southern Kansas and later in western and northern Kansas,

RATE OF PLANTING

It is a difficult matter to obtain always the proper stand of corn, for there are many factors beyond the control of the farmer that reduce the stand. The general tendency is to plant much too thick, with the hope that enough corn will survive to make a satisfactory yield. This practice is not always the best, as too often the corn is too thick for satisfactory results. If a good seedbed is prepared and seed of strong vitality is used, it will be much easier to secure the proper stand.

The rate of planting should vary with the size of the variety, the fertility of the soil, and the average rainfall. A small-growing, early-maturing variety may be planted much thicker than a large-growing, late-maturing one. Likewise it should be thicker on rich bottom land than on thin uplands.

Experiments at Manhattan have given the results indicated in Table VI. Pride of Saline has been used in these tests. The corn has been drilled in rows 3½ feet apart.

TABLE VI.—Relation of rate of planting to yield.

DISTANCE APART OF PLANTS IN THE ROW.	Average yield—bushels per acre. Creek bottom land, 1914 to 1918.	Upland, 1914 to 1924 (1918 omitted).
12 inches	37.9	51.8
16 inches	50.7	52.3
20 inches	49.4	52.3
24 inches	48.7	50.6
28 inches	47.8	46.3
32 inches	44.9	44.4

It will be seen that spacing the kernels anywhere from 16 to 24 inches apart has made no marked difference in yield. There has, however, been a considerable difference in the size and number of ears, they being more numerous and smaller for the thicker rates. Since the cost and inconvenience of husking increases as the ears become smaller, it is evident that planting thicker than is necessary to secure the highest yield is not the best practice. It seems that on good land in eastern Kansas the plants generally should be spaced from 16 to 18 inches apart in the drilled row or if check-rowed, from 2 to 3 kernels per hill,

In central Kansas spacing the plants 24 to 30 inches apart and in western Kansas 30 to 36 inches apart is not too thin for average conditions. If corn is grown for silage somewhat thicker planting may be desirable.

THE DEPTH TO COVER CORN

Corn should be planted sufficiently deep to insure the kernels being placed in moist soil without danger of drying out. The depth is governed largely by the nature of the soil, by its moisture content when the corn is planted, and by the time of planting. As a rule one and one-half to three inches is about right. On wet, heavy soils, one and one-half inches, or possibly less, may be sufficient, while on light, sandy soils three inches or more may be necessary for the best results. Deep planting is often desirable in western Kansas to prevent the soil around the corn from drying out. Corn need not be covered so deeply early in the season as when planted late, as the ground does not dry out so rapidly at that time of the year.

PREPARING THE SEEDBED

The nature of the preparation of the seedbed for corn varies with the soil, the annual precipitation, the preceding crop, and the seasonal conditions, as well as with the method of planting. In most parts of the state thorough and early preparation of the land before planting is a profitable practice.

PREPARING THE LAND FOR LISTED CORN

Since corn can be planted with a lister without any previous treatment, too little attention is given the preparation of the land where this method of planting is employed. The most common practice is to list the ground when the grain is planted. A better method is to cultivate the land sufficiently previous to listing to insure control of weeds and good tilth of the soil. This may be done in various ways, the most practical perhaps being with a disk or a lister.

Disking

Spring disking is the most popular method of preparing ground for listed corn, and on the whole, is very satisfactory. This treatment leaves the ground in excellent condition to absorb and retain moisture, cuts up and works into the ground cornstalks and trash, kills weeds that have started, and hastens the germination of those that have not sprouted.

The time to disk in the spring depends upon a number of conditions. If the alternate freezing and thawing of the ground has left the soil loose on top, disking is not necessary or advisable until a crop of weeds has started. If the ground comes out of the winter in a crusted condition, or is crusted by heavy early spring rains, it is a good plan to disk as early as the condition of the ground will permit. A second disking is often desirable if heavy rains pack the ground or a crop of weeds starts too far in advance of planting time. Disking puts the ground into better condition for listing and cultivation, and the advantage gained in this way is often sufficient to pay for the extra work even though no increase in yield is obtained.

Fall Listing

Usually fall or early spring listing gives excellent results. Of the two, fall listing is the better practice since it puts the land into ideal condition to absorb rain, and hold snow during the winter. The ridges may be split at planting time or the corn may be planted in the old furrows.

A method that has given excellent results with sorghums in western

Kansas and should be equally as satisfactory for corn, consists of listing in the fall and disking or harrowing the ground in the spring as soon as weeds start to grow. At planting time the lister is run in the old furrows which by that time are partly filled with dirt worked in from the ridges. This fine mellow earth is in excellent condition for the seed and germination usually takes place at once and subsequent growth is rapid.

Listing early in the spring and again at planting time does not always give satisfactory results, especially if the weather is dry

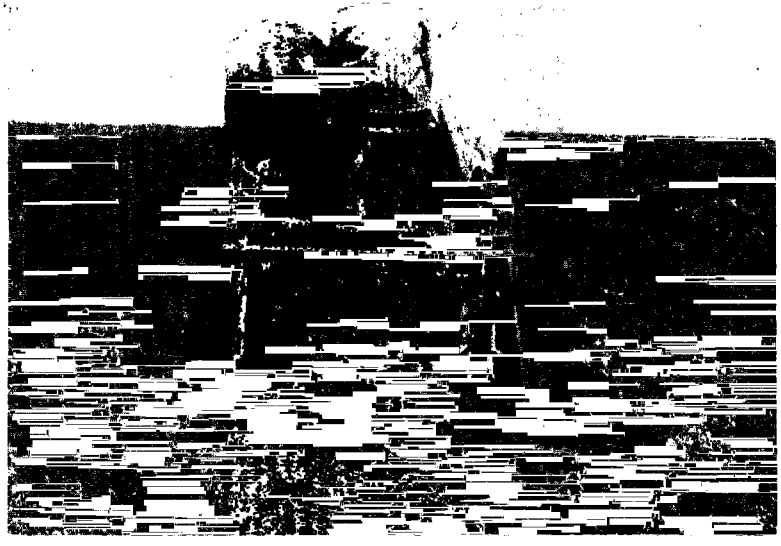

FIG. 13.—Planting corn in lister furrows a day or two after listing. This method is sometimes known as blank listing.

throughout the spring, because of the greater drying out of the surface soil. This method is sometimes used on heavy soils in eastern Kansas.

Blank Listing

A practice that is rapidly coming into favor in certain sections of eastern Kansas is to list the ground late in the spring and plant in the same furrows. (Fig. 13.) Where the planting is delayed for some time after the ground has been listed, the bottom of the furrow has an opportunity to become warm, and a better germination and a stronger growth of the corn is obtained. Thus one of the disadvantages of listing is avoided, while all of the advantages are retained.

Plowing for Listed Corn

Plowing either in the fall or early spring, and then planting corn with a lister, is an excellent method of preparing a seedbed for corn, provided the ground becomes sufficiently settled to permit a good job of listing. It is not a practical method, however, for central and western Kansas and in general if it is desirable to plow the ground, surface planting will give as good or better results than listing. While the method is not generally recommended it may be found useful for heavy soils in eastern Kansas. The plowing in such cases. should be shallow.

FIG. 14.—Plowing in the fall for corn.

PREPARING THE LAND FOR SURFACE-PLANTED CORN

Where the corn is to be surface planted, fall or early winter plowing, as a rule, is advisable, although experiments in general have failed to demonstrate any marked difference in yields. Land fall-plowed is more thoroughly subjected to weathering agencies during the winter and these put the soil in better physical condition and tend to liberate larger quantities of plant food. Fall plowing also results in the destruction of many insects which are injurious to corn, and this fact alone often makes it desirable to plow in the autumn. Possibly the most important advantage of fall or winter plowing is in having it done and out of the way of spring work. (Fig. 14.)

Heavy clay soils, when plowed early in the fall, may need to be plowed a second time in the spring for best results, because of the

tendency of the soil to run together and become too compact. In such cases spring plowing will usually prove more profitable.

Depth of Plowing

The depth to plow varies with the nature of the soil and the time when the work is done. Deep fall plowing, that is seven to eight inches, is advisable on nearly all good corn land. On thin soils, especially when the top soil has been washed away, deep plowing may not be advisable, and in some cases may be injurious. Where the ground has not been plowed previously more than four or five inches, it is best to increase the depth gradually until the desired depth is reached, as turning up a considerable amount of unweathered soil may result in decreased yields the first season.

CULTIVATING CORN

Every farmer realizes that it is necessary to cultivate corn to secure the best yields, but not everyone knows just why cultivation is beneficial. If he did, considerable labor could no doubt be saved and better yields obtained.

The reasons most frequently given for cultivating corn are to control weeds, to establish a dust mulch in order to conserve moisture, to liberate plant food in the soil, and to put the surface soil in the best condition to absorb rain. All of these are probably important, at times, but in general the control of weeds is more necessary than any of the others. This fact is illustrated by experiments conducted by the Agricultural Experiment Station on the Agronomy Farm at Manhattan, in which four methods of cultivation have been compared: (1) Ordinary cultivation, that is, three or four during the season and the corn laid by with no further attention; (2) ordinary cultivation followed by cultivation with a one-horse cultivator during the summer as seemed to be desirable in order to mulch the soil or kill small weeds; (3) ordinary cultivation followed by cultivation with a one-horse cultivator every ten days; (4) no cultivation whatever after planting, but with the weeds removed by scraping the surface of the ground with a hoe. The results of these experiments, which have been continued for nine years, are presented in Table VII.

TABLE VII.—Yields of corn secured by four methods of cultivation.

METHOD OF CULTIVATION.	Yield in bushels per acre.									
	1914	*1915*	*1916*	*1917*	*1919*	*1920*	*1921*	*1922*	*1923*	*Av.*
Ordinary cultivation	13.0	65.1	43.9	39.7	27.7	74.8	60.1	50.6	61.5	49.2
Ordinary cultivation, followed by one-horse cultivation during summer as seemed desirable	13.4	62.0	43.3	39.5	26.1	77.5	63.9	52.9	59.6	49.2
Ordinary cultivation, followed by one-horse cultivation every ten days during the summer	11.0	58.8	43.5	39.6	24.4	76.3	64.5	52.8	58.9	48.1
Not cultivated. Weeds removed by scraping	9.2	65.0	45.3	35.1	25.7	76.0	65.7	55.4	61.0	48.4

It is a rather surprising fact that practically no gain was secured by cultivating beyond that necessary to control weeds. It is important to note that the ground has always been in excellent condition when the corn was planted. Similar results have been secured in other states. It follows from this that if land is kept as free of weeds as is possible by good cultural methods, rotation of crops, and getting the land in good condition before planting, the cost of cultivation may be reduced very materially. Time can often be saved by harrowing the corn just before it comes up, or after it is up but before it has made sufficient growth to be injured. This may be very important when wet weather interferes with later cultivation.

HARVESTING CORN

The general methods of harvesting corn practiced in Kansas are: (1) Cutting and shocking for rough feed; (2) cutting for silage, and (3) husking the grain from the standing stalks. The third method is most extensively employed. The value of stover is receiving greater recognition, however, and the practice of saving it for feed is becoming more general.

Corn should be cut for fodder when the bottom leaves become dry, which, under ordinary conditions, is shortly after the ears become well glazed. It possesses its maximum feeding value at this time. If cut too soon it will be more subject to damage from weather and fungous growths and will yield less than if cut at the right time. If the cutting is delayed the stover deteriorates rapidly in quality.

When corn is produced for feeding cattle, the greatest returns can be obtained by using it as silage. It should be cut when the ears become well glazed. Corn that fails to make grain because of drouth should be allowed to stand and mature as completely as possible without too great a loss of leaves. If too dry to pack thoroughly, enough water to moisten it may be added as it is put into the silo.

The value of the silo for saving immature corn was well shown in 1913, when corn that had dried up and was harvested in the usual manner rotted in the shock and was practically worthless, while the same kind of corn placed in the silo made good feed.

SHRINKAGE OF CORN DURING STORAGE

Many farmers grow corn for market, and it is often a question whether it is preferable to store the grain for higher prices or to dispose of it as it is harvested. Whether corn should be sold at once

depends upon the market, the condition of the corn at harvest time, and the facilities for storage, There is always more or less loss in storing corn because of shrinkage, damage from weather, and the injury from mice and other vermin. Experiments show that corn dry enough to crib if kept in good condition protected from weather, mice, and rats will shrink in weight from 5 to 10 per cent when stored for a period of six or more months, the shrinkage depending on the condition of the corn when cribbed and the seasonal conditions that follow. If it contains an excess of moisture or is exposed to the weather or other sources of loss the shrinkage may be as great as 15 or even 20 per cent.

SEED CORN

The vitality of the seed has much to do with the yield of corn. Seed of strong vitality that will germinate and insure a vigorous growth of the young plants, even though conditions are unfavorable, is necessary if maximum yields are to be obtained. Since one bushel of corn will plant from seven to twelve acres of land, from which, under ordinary conditions, there is obtained from three hundred to five hundred bushels of grain, it is evident that too much importance cannot be attached to the selection and care of the seed. Every corn grower is warranted in spending considerable time and money in order to obtain first-class seed.

SELECTING SEED CORN

There is only one really satisfactory method of securing seed, and that is to select it in the field after the corn becomes mature and before a severe freeze. At this time the maturity and the conditions under which the ears were grown can be noted. If an earlier or later strain of corn is desired, ears of the desirable kind can be obtained readily. The conditions under which an ear is grown ordinarily determine its size. Some ears are larger than the average because of a thin stand or other advantages, while others are large because of the natural vigor of the plants upon which they were grown. The latter are the ones that should be selected for seed. If the seed corn is selected from the wagon or from the crib there is no way of ascertaining the conditions under which it was grown or the kind of a stalk from which it came.

The stalk is of as much importance in the breeding or improvement of corn as is the ear. Seed should be selected from strong upright leafy stalks of medium height. The ears should be attached

at a convenient height for husking, should have a shank of medium length and diameter, and hang down sufficiently to prevent water from entering the tip. Ears that are about the average in size are the most desirable for seed purposes. (Fig. 15.) Extremely large late-maturing ears should be avoided. (Fig. 16.)

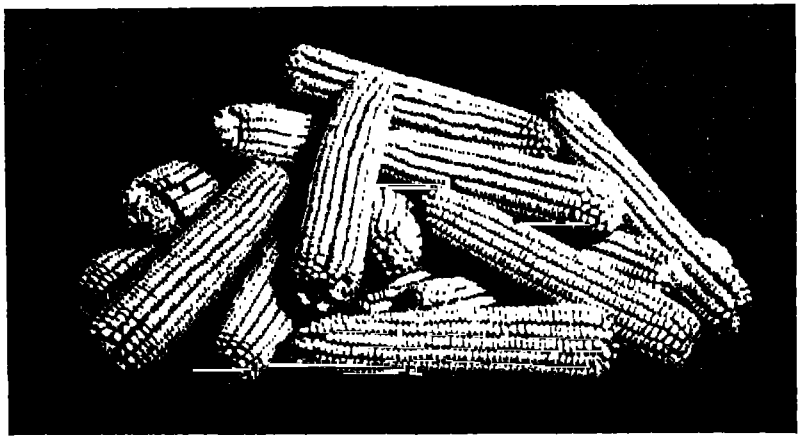

FIG. 15.—Desirable seed ears. Note the sound, fully-matured, bright, lustrous kernels.

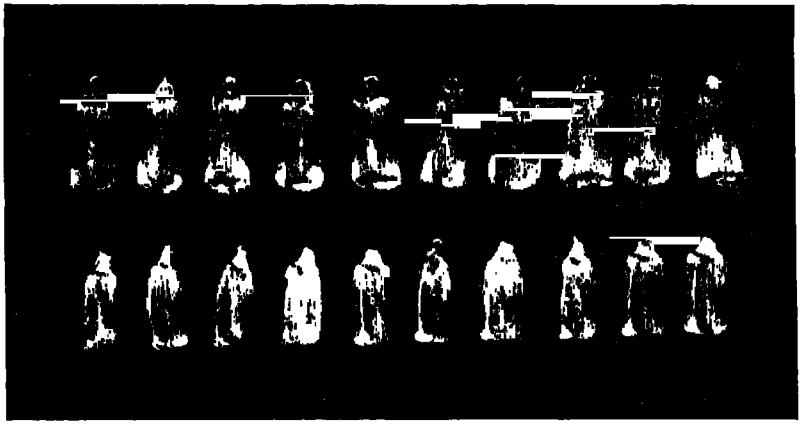

FIG. 16.—Kernels from a well-matured ear (lower) and an immature ear (upper). Note the large proportion of crown starch in the latter extending nearly half the length of the kernels. Plants from such kernels are deficient in vigor, often low in germination, and usually susceptible to disease injury.

Relation of Ear Characters to Yield

Extensive experiments in many parts of the United States have shown that with one possible exception there is no definite relation between ear characters and yield, so long as the ears are sound, mature, and not too small. In other words, it seems to make little difference whether the ears are cylindrical or tapering, have well-filled or poorly filled butts and tips, whether the rows are straight or crooked, or whether the kernels are wedge-shaped or some other shape.

On the other hand there does seem to be a definite relation between the length and indentation of the kernel and yield. If the kernels are too long the corn will require a longer period to ripen and may not thoroughly mature. The seed will not germinate so well and the plants will be more easily attacked by disease. Long kernels are as a rule deeply indented such that the ears are often described as rough. It is for this reason that it has been found recently that rough ears tend to be poorer in germination and produce lower yields than somewhat smoother ears with shorter kernels. Rough, deeply dented ears usually have a dull appearance strongly contrasted with the bright lustrous appearance of smooth ears.

In selecting seed corn it will pay to give considerable attention to securing sound, well-matured ears free from all indications of mold or disease and with horny kernels that are bright and lustrous such as those shown in figure 15. The quite general practice of selecting the largest ears with the longest kernels that are deeply indented should be abandoned. On the other hand one should not go too far in the other direction, especially in eastern Kansas, since the selection of the extremely short, flinty type of kernel will eventually result in a variety of corn that matures too early for maximum yields. For central and western Kansas the latter are the only types that can be grown successfully.

STORAGE OF SEED CORN

From two to three times as many ears as will be needed for seed should be obtained in making the field selection, since many of them will be found unsuitable when a closer examination is made. They should be dried thoroughly and stored under conditions where they will keep dry. Dry corn will not be injured by freezing. After the corn becomes dry it may be stored in any well-ventilated room or outbuilding where it will be free from rats, mice, and other vermin. Corn that matures properly in the field can be stored without extra

precautions in drying, but that which matures late and contains considerable moisture when the first frost occurs must be artificially dried to insure seed of good germinating power. One of the best places to dry corn is in the machine shed, the attic, or some other well-ventilated place in which the temperature will be above freezing until the grain is dry.

GERMINATION TESTS

In the winter a germination test should be made. A composite sample of corn should be secured, made up of several grains taken from different places on each of a hundred or more ears. Thoroughly mix these kernels and take a sample of at least one hundred grains for the germination test. If 95 per cent or more of the grains germinate satisfactorily — that is, send out strong, vigorous sprouts — the seed may be considered good. If more than 10 per cent of the grains fail to germinate satisfactorily, other seed of known quality should be secured, or a test of each ear made (figs. 17 and 18) and the ears of low vitality discarded.

FIG. 17.—Results obtained in a germination test of corn. The kernels in each square are from a different ear. Only three of the nine ears tested germinated satisfactorily.

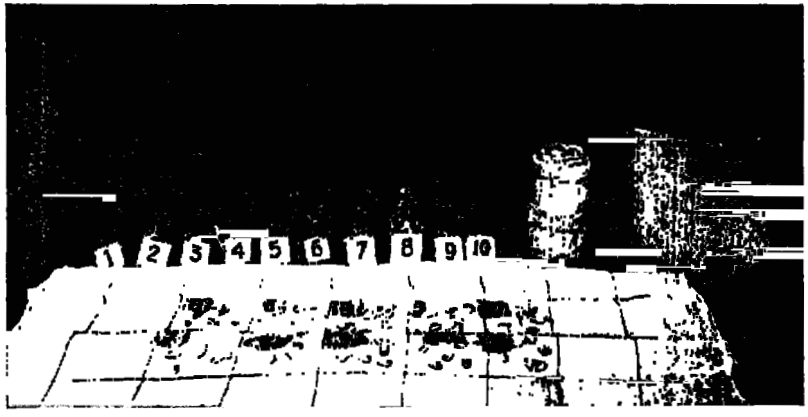

FIG. 18.—A farmer's germination test of individual ears. The ears are numbered to correspond with the numbered squares. As soon as the kernels are in place, the muslin is folded over at the edge and rolled into a "doll." The doll is then placed in a covered jar or other receptacle or is merely covered with a damp cloth to keep it from drying out. If kept at a warm temperature the test can be read in four or five days.

INSECTS INJURIOUS TO CORN

Corn, like many of the larger plants, attracts a considerable insect population, A recent compilation shows that over 300 insect species are associated with this plant. Every part of the corn plant is subject to insect attack and, with the exception of the ear, every part is easily accessible, Even the ear is not immune to attack.

In this connection it is of interest to note that with a few exceptions all are native insects. Also, in nearly every case these insects are not dependent on the corn plant. If the corn is present, they may show a preference for it. If corn is not available, they may feed on a variety of other plants.

While the number of insects infesting corn is very large, the number which causes serious losses is exceptionally small. In Kansas, there are probably not over 20 species that may be regarded as serious pests of this crop. Only such insects as are of great economic importance to the farmer will be discussed in this bulletin.

Chinch Bugs.—The chinch bug is probably the best known and the most destructive of the insects injuring corn. Under favorable conditions it may cause an enormous loss to the crop, and in some cases entire fields may be destroyed. The greatest injury occurs when the fields of small grains have ripened and the young bugs are

forced to migrate to the corn where they feed on the outside rows. As these plants are killed, they advance farther into the field. They become full grown soon after reaching the corn and fly then to all parts of the field to deposit eggs. The damage from this second brood is not so noticeable, because of the general distribution of the bugs over the entire field.

The most efficient means of controlling the chinch bug is to burn over in the fall all clump-forming grasses in waste places, roadsides, fence rows, and other such places where the great majority of them hibernate. The chinch bug can be prevented from migrating to the cornfield by constructing and maintaining a creosote-posthole barrier between the small grain and the cornfield during the migration period. This barrier is made by plowing a furrow between the infested and noninfested fields, the dirt being thrown away from the former. A line of creosote from one-half to three-fourths of an inch wide is then poured near the top of the ridge on the side nearest to the noninfested field. The creosote is best applied from a gallon bucket having an eight-penny nail hole in the center of the bottom. By using a long wire bail, the operator can walk alongside the barrier, directing the stream of creosote on the desired line. (Fig. 19.)

In using creosote, it is necessary that the line be renewed daily during the period of heaviest migration. Since the bugs usually do not begin moving until about 3 o'clock in the afternoon, it is not necessary to apply the creosote until shortly before the daily migration starts. Each application should be made along the same line, since the efficiency of the barrier increases with the number of applications.

Creosote is merely a repellent agent and does not kill the insects. The bugs, on approaching the barrier, are repelled by the odor, with the result that they turn and follow along the line. Two methods may be used for killing the bugs as they travel along the barrier, The most effective one is to dig postholes at intervals of about a rod. These holes should be about 12 inches deep and the rims flared somewhat. Wings of creosote should extend at right angles out past the holes two or three feet in order to guide the bugs into the trap. The bugs may be killed by placing from one-fourth to one-half of an ounce of calcium cyanide in each hole daily.

Corn Earworms.— With the exception of the chinch bug, the corn earworm is probably the most injurious insect attacking corn in Kansas. Every corn grower is familiar with the plump, green-

FIG. 19.—A creosote-posthole barrier showing method of pouring creosote with a long-handled gallon bucket.

striped caterpillar found in the tip of the ear. This insect is distributed over the entire state, and it is not unusual for from 90 to 100 per cent of the ears in the field to be infested. The injury by this pest consists in feeding in the tender curl of the plant and on the silk and young kernels. The loss due to the actual eating of the grain is considerable, but it is greatly increased by the subsequent growth of molds and fungi on the ear as a result of the earworn infestation. Corn which is badly worm-eaten or moldy should not be fed to horses, as it sometimes produces a disease closely resembling blind staggers.

At the present time there is no satisfactory way of absolutely controlling the earworm. The extent of injury may be greatly reduced by fall plowing and by planting as early as advisable in the spring. At Manhattan, the optimum time to plant corn to reduce the amount of earworm injury to the minimum is about May 1. In southern Kansas, the date is about April 20.

Grasshoppers. — Throughout western Kansas, the grasshopper is a serious enemy of corn, and it is not unusual for large areas to be entirely devastated by this pest. The injury consists in the defoliation of the stalk, and often can be effectively controlled in and around cornfields by means of the poisoned bran mash. This mash is made according to the following formula:

Bran	20 pounds
White arsenic or Paris green	1 pound
Sirup	2 quarts
Water	3½ gallons
Oranges or lemons	3

In preparing the bran mash, thoroughly mix the dry bran and poison in a washtub. Squeeze the juice of the oranges or lemons into the water, and chop the remaining pulp and the peel to fine bits and add them to the water. Dissolve the sirup in the water, and wet the bran so as to dampen the mash thoroughly.

This mash should be sown broadcast in the infested areas early in the morning, or about the time the grasshoppers are beginning to move about from their night's rest. It should be scattered in such a manner as to cover from four to five acres with the amount given by the formula.

Cutworms. — There are a number of species of cutworms which feed upon corn. Ordinarily they do little damage to the crop, but occasionally they become numerous enough to reduce greatly the

stand. The cutworms are thick, soft-bodied worms, which vary in color from whitish to dark brown or black. They are night feeders, and hide during the day in holes or under clods. In feeding, they cut off the plant at or near the surface of the ground. The moths of the cutworms deposit their eggs mainly in grassland, and one of the chief means of the prevention of injury is not to plant corn in sod land. Where the worms are serious in a field, they may be destroyed by means of the poisoned bran mash as described in the discussion of the grasshopper. Since cutworms usually feed at night, the poisoned bran mash should be scattered early in the evening.

Army Worms.—The army worm is a plump, greenish-black caterpillar, having three stripes along each side—the middle one dark and the others light—and a narrow, broken stripe of white down the middle of the back. Army worms are most commonly found in grass land or in fields of small grain, especially rye. When they occur in large numbers, they may do considerable damage to corn and other crops.

Where the army worms are migrating to the cornfield, they may be destroyed by means of the poisoned bran mash discussed above.

This bran mash should be sown broadcast just ahead of the worms. The best time to scatter it is in the evening about the time the worms are becoming active. The migrating worms may be destroyed by surrounding the field with a deep furrow and then dragging a heavy log up and down this furrow so as to produce a dust mulch.

Maize Billbugs.—The maize billbug has become a serious pest along the river valleys throughout south central Kansas. The adult beetles are black in color and about three-fifths of an inch in length. They deposit their eggs in the corn stalks, and the young worms burrow up and down the stalks, causing the plant to have a stunted appearance and often to sucker freely. Stalks injured by the billbug rarely produce ears. The chief means of control for this insect is rotation of crops. The beetle does not fly, and consequently is limited in its dispersal. The plowing out of the corn stubs in the fall will destroy a large number of the overwintering adults.

Corn Root Lice.—The corn root louse is a small bluish-green insect found on the roots of corn, and usually attended by small brownish ants. This insect is becoming a serious pest in Kansas and has caused a large amount of damage during the past few years.

The injury consists of the weakening of the plants, causing them to make little or no growth and to turn yellow.

Corn root lice are dependent on the small brown ants, which care for them at all seasons. During the winter, the eggs are taken care of by the ants, and when the eggs hatch in the spring, the ants carry the young lice to the roots of the corn. During the summer the ants continue their care of the lice.

The corn root louse may be controlled by late fall plowing, which destroys the nests of the attendant ants, or by rotation. Where these insects are present, corn should not be grown for more than two years in succession on the same land.

Corn Root Worms.—The corn root worm is a small white larva, about one-half inch in length when full grown. It feeds within the roots, boring holes throughout the length of the larger roots, and practically destroying their usefulness. Corn infested by this pest is very likely to have an unthrifty appearance and may go down badly. This insect can be successfully controled by rotation of crops.

European Corn Borers.—The European corn borer is probably the most serious pest of corn that has been found in the United States. While it is not known to occur in Kansas, it is now abundant in many areas in the eastern states. During the season of 1925, severe damage occurred in Ontario, Canada, and in parts of Ohio, Pennsylvania, and Michigan. The European corn borer is best known in the larval state. The worms are to be found boring into all parts of the stalk, ear, and tassel of the corn plant and to some extent feeding on the leaves. These larvæ may be recognized by their brown head and grayish to pinkish body with two dark brown spots on the back of each body segment. It is important, owing to the seriousness of this pest, for every corn grower to be on the lookout for any unusual insect injury in his fields. The discovery of any insect that resembles the European corn borer should be reported to the entomologist of the Agricultural Experiment Station in order that any infestation may be dealt with in its incipient stage.

GENERAL METHODS OF INSECT CONTROL

Many of the insect enemies of corn can be controlled by proper handling of the ground and rotation of crops. Fall plowing is very effective in destroying many species which hibernate in the soil.

Where fall plowing is not practical, early spring working of the soil is often effective.

A rotation including a crop or two of small grain is very effective in ridding the soil of many insects, provided the ground is plowed soon after the grain is harvested and is kept in a clean condition for the rest of the season. When the ground is kept free from vegetation, the insects are forced to migrate to other fields or starve.

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